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EXPERIMENTAL INVESTIGATION ON DIESEL ENGINE FUELLED WITH BLENDS OF COCONUT AND NEEM OIL

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ABSTRACT

The way that oil based fuels will neither be accessible in adequate amounts nor at a sensible cost in future has restored in investigating substitute fuels for diesel engines. Therefore, vegetable oils are utilized as a substitute fuels for compression ignition engines. The present work contemplated the attainability with two blends produced using coconut and neem oil with requirement of diesel for mixing and also the physicochemical properties of the mix be determined. Upon mixing the properties of fuel were essentially changed and acclimated towards ordinary particulars. Diesel is utilized as a control. A single cylinder kirloskar diesel engine with DC generator is selected for this investigation. The purpose of the present investigation is to find out the performance characteristics of diesel engine utilizing the blends of coconut and neem oil. Mixing of coconut and neem biodiesels with utilizing diesel formed attractive properties of fuel. In conclusion, the dual biodiesel blend B50 gives enhanced performance compared to all other blends. Therefore, the blend B50 is taken as optimum blend.

***KEYWORDS:** Bio diesel, Coconut, Neem, Blending, Performance Characteristics & Diesel Engine*

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Original Article

INTRODUCTION

Biodiesel is an elective fuel like regular or pure diesel. Biodiesel can be delivered from vegetable oil, creature oil, fats, fat and waste cooking oil. The biggest conceivable wellspring of reasonable oil originates from oil yields, for example, coconut, neem, palm or soya bean. In numerous nations coconut oil and neem oil speaks to the best potential for biodiesel creation. A large portion of the biodiesel created at present is delivered from coconut and neem oil mixes with diesel and attempted to keep running on a pressure start motor. Biodiesel has numerous natural helpful properties. For the most part biodiesel has a higher glimmer point than diesel. After the expense of changing over it to biodiesel has been included it is just too costly to even think about competing with diesel The outcome is biodiesel created from the coconut and neem oil can contend with diesel. It is discovered that motors treated with coconut oil as an oil added substance created no pretty much smoke than without coconut oil. Motor upkeep costs or decreased when contrasted with the utilization of mineral based motor greases. Cocount oil is additionally less expensive, enduring over a time of utilization in a vehicle driven every day. In current situation, the possibility of the creation of biodiesel from coconut and neem oil trying to deliver biodiesel utilizing inexhaustibly developed tree normally as the utilization of vegetable oils for motor powers is by all accounts immaterial.

Neem oil is usually light to dark brown in colour. It contains a lot of triterpenoid compounds, responsible for its unpleasant taste. Coconut oil, then again, is lackluster or yellow in color and has a amusing taste. Biodiesel contains unsaturated fats which is obtained with the employment of transesterification process. Environmentally friendly liquid fuel like diesel as far as burning properties. Expanding natural concern, reducing oil saves are the main reasons for the production of biodiesel. With horticultural ware costs moving towards lesser than petrol costs, unsaturated fatty acids delivered as of plant oils are turned into worthwhile derivative of fuel. Expanded use of inexhaustible fuels can result in immense microeconomic advantages for both the mechanical and agrarian parts [1, 2]. Sanjid et al. [3] experimentally investigate performance and emission of different biodiesels obtained with edible and non-edible oils like Calophyllum inophyllum. From the results, it is concluded that it can be used as a substitute fuel. S. H. Shuit et al. [4] investigated that the economic possibility and continuity of changing palm oil to profitable goods, artificial biodiesels and also for generation of power has been investigated. P. McCarthy et al. [5] researched that the performance characteristics of a diesel engine utilized with two bio-diesels are determined and contrasted with that diesel fuel. K. Anbumani et al. [6] experimentally investigated on the C. I engine and evaluated performance characteristics of diesel engine fuelled with the blends of mustard and neem oil. M. A. Kalam et al. [7] utilized waste cooking oil with various mixes and conducted an experiment on diesel engine and determined performance attributes of a compression ignition engine. H. K. Patel et al. [8] carriedout an experiment on compression ignition engine by utilizing jatropha oil and aluminium oxide with diesel and evaluated performance attributes of a C. I engine. P. R. Shah et al. [9] evaluated the emission and combustion attributes of a diesel engine with the utilization of fuel additives in direct vegetable oil. S. V. Channapattana et al. [10] assessed the performance attributes of a C. I engine with the mixes of methyl ester of Honne oil with diesel as a fuel and also determined the impacts of fuel infusion timing. Yuan-Chung Lin et al. [11] utilized waste cooking oil with diesel fuel in a C. I engine and evaluated performance attributes of a diesel engine and observed that waste cooking oil could be used as a substitute fuel for compression ignition engine. A. Atmanl et al. [12] determined the performance attributes of a C. I engine with the utilization of cotton oilen and butanol blends and also determined the impacts with the accumulation of n-butanol in diesel engine. P. Tamilselvan et al. [13] determined the performance and exhaust emission attributes of a diesel engine with the utilization of pine oil blends. It is observed that the pine oil viscosity is lesser and heating value is greater when contrasted with the diesel. V. K. Kaimal et al. [14] determined the performance and combustion attributes of a C. I engine and also examined the impacts of utilizing two distinct fuels which is obtained by two different methods. S. Kent Hoekman et al. [15] observed that there is a reduction in CO and HC emissions, increment in NO_x emissions with the utilization of biodiesel. B. Dhinesh et al. [16] utilized Cymbopogon flexuous biodiesel with diesel fuel and tried to run on a diesel engine and evaluated the performance and emission attributes of a diesel engine. Gaurav Dwivedi et al. [17] conducted an experiment on C. I engine with the utilization of pongamia oil and evaluated the performance attributes of a diesel engine and observed that PE20 blend gives better performance under cold climatic conditions.

Coconut Oil

Coconut oil is additionally known as copra oil, is a consumable oil separated from the kernal or meat of develop coconut reaped from the coconut palm. It has different applications. In view of its high soaked fat substance, it is delayed to oxidize and, accordingly, impervious to enduring as long as a half year at 24^0C without ruining. For the most part it is created from the dry and wet procedure. Dry handling necessitates that the meat be removed from the shell and dried utilizing discharge and daylight to make copra. The copra is squeezed or broke down with solvents, creating the coconut oil and a high protein, high fiber-pound. In wet procedure, the protein in the coconut milk make an emulsion of oil and water. The fundamental issue which is associated

with wet procedure is separating the emulsion to recoup the oil and it isn't practical. Current strategies utilize radial and pretreatment including cold, heat, acids, salts, catalysts, electrolysis, stun waves and some another techniques.

Neem Oil

Azardirachtaindica is the botanical name of neem. It has a place with the family maliacae. The pieces contain 40%-half of a harsh unpleasant greenish yellow to darker oil with solid upsetting garlic like scent. This unpleasant is to the nearness of sulfur containing mixes like nimbin, nimbidin and nimbo sterol. It is rich in oleic corrosive, trailed by stearic, palmitic and alcolinic acids. The oil is utilized for pharmaceuticals, beautifiers and medicinal fields. It is basically accessible in india and west africa. The purpose of the present investigation is to find out the performance characteristics of diesel engine utilizing the blends of coconut and neem oil. Mixing of coconut and neem biodiesels with utilizing diesel formed attractive properties of fuel. In conclusion, the dual biodiesel blend B50 gives enhanced performance compared to all other blends. Therefore, the blend B50 is taken as optimum blend.

Table 1: Scientific Classification of Coconut Oil

Kingdom	Plantae
Divison	Liliopsida
Class	Liliopsida
Order	Arecales
Family	Arecaceae
Genus	Cocos L.
Species	C. nucifera
Binomial name	Cocos nucifera

Table 2: Fatty Acid Composition of Coconut Oil

Fatty Acid	Structure	Percentage (%)
Palmitic	C16:0	9.0
Stearic	C18:0	3.0
Oleic	C18:1	5.0
Linoleic	C18:2	1.8
Lauric	C12:0	49.0
Myristic	C14:0	17.5

Table 3: Scientific Classification of Neem oil

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliophyta
Order	Sapindales
Family	Meliaceae
Genus	Azadirachta
Species	A. indica
Binomial name	Azadirachtaindica

Table 4: Fatty Acid Composition of Neem Oil

Fatty Acid	Structure	Percentage (%)
Palmitic	C16:0	16
Stearic	C18:0	13
Oleic	C18:1	46
Linoleic	C18:2	14
Linolenic	C18:3	-

MATERIALS AND METHODS

Figure 1: Coconut Oil and Neem Oil.

Table 5: Properties of Coconut Oil and Neem Oil

Properties	Diesel	Coconut Oil	Neem oil
Density (g/cm3)	830	928	910
Kinematic viscosity at 40^0 C (centistokes)	2.7	31.6	40.75
Calorific value (KJ/Kg)	45350	40500	39820
Specific gravity	0.834	0.93	0.91
Flash point (^{o}C)	53	270	250
Fire Point (^{o}C)	62	280	258

In present study, experimentally investigate the potential use of coconut and neem oil blends with diesel fuel. For this project work, purchased coconut oil and neem oil blends with various percentages and conducted an experiment on single cylinder kirloskar diesel engine with dc generator at different loads and determined the performance parameters such as BSFC, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency and volumetric efficiency.

Blends Taken

B10 (5% coconut oil + 5% neem oil + 90% diesel)

B20 (10% coconut oil + 10% neem oil + 80% diesel)

B30 (15% coconut oil + 15% neem oil + 70% diesel)

B40 (20% coconut oil + 20% neem oil + 60% diesel)

B50 (25% coconut oil + 25% neem oil + 50% diesel)

EXPERIMENT

In this exploration, 4-stroke compression ignition fuelled engine with DC generator loading having 5HP as rated power at 1500 rpm is used. Experimental setup is demonstrated in Figure 2. The stream rate of the fuel is estimated on the volumetric premise utilizing stopwatch and burette. The type of the CI engine is water cooled. Diesel engine specifications is demonstrated in Table 2.

Table 6: Specifications of Diesel Engine

Make	Kirloskar Make, Compression Ignition with D. C. Generator
No. of cylinders one	One
Bore	80 mm
Coefficient of discharge (Cd)	0.62
Capacity	4 KW
Diameter of Orifice (d)	20 mm
Stroke	110mm
Compression ratio	16:1
Maximum Current	13 amps
Efficiency of dynamometer	80%
Armature voltage	220V

The procedure of the experiment is discussed as below.

- The tank is filled with the raw Coconut oil and Neem oil blend is taken.
- The pipe should be checked that there should be no air bubbles and the pipe is connected to the engine.
- The decompression switch is proceeded so that there will be no air getting amidst barrel and the chamber.
- At that point motor is to be commenced and it is permitted to get the speed, easily for a couple of moments.
- By means of the tachometer, speed of the engine is estimated.
- Now take down the voltmeter, ammeter readings, time taken for utilization of fuel on no load conditions and pursuing of manometer.
- At that point the motor is stacked by gradually bringing down the copper plate in water rheostat.
- In the wake of applying of burden on the motor at set point, take down the readings.
- A similar method is rehashed for various values.
- Different blends of Coconut oil and Neem oil with diesel such as 10% (coconut-5%, Neem-5% and diesel-90%), 20% Coconut oil and Neem oil (coconut-10%, Neem-10% and diesel-80%), 30% Coconut oil and Neem oil (coconut-15%, Neem-15% and diesel-70%), 40% Coconut oil and Neem oil (coconut-20%, Neem-20% and diesel-60%), 50% Coconut oil and Neem oil (coconut-25%, Neem-25% and diesel-50%) be arranged and tried for its performance characteristics.
- Same procedure is continued for Coconut oil and Neem with different blends.

Figure 2: Experimental Setup.

RESULTS AND DISCUSSIONS

Engine Performance Parameters

Brake specific fuel consumption	BSFC
Brake thermal efficiency	η_{BTH}
Indicated thermal efficiency	η_{ITH}
Mechanical efficiency	η_{ME}
Volumetric efficiency	η_{VOL}

Brake Specific Fuel Consumption

From the figure 3, it is noticed that the BSFC of the engine with B50 blend is lower compared to B10, B20, B30, B40 and diesel. This is mainly caused by greater density of the Neem and coconut oil. The effect of BSFC of raw Neem and coconut oil and its blends with respect to brake power is demonstrated in figure 3. The higher density of the coconut oil has incited more release of fuel for a similar dislodging of the fuel infusion siphon. Consequently expanding the utilization of fuel.

Brake Thermal Efficiency

Figure 4 indicates that increase in brake power of the engine, increases in brake thermal efficiency of the engine. In other words it could be assumed that brake power is directly proportional to the brake thermal efficiency. From the figure it is evident that neem and coconut oil blend B50 has greater brake thermal efficiency. The reason for increment in brake thermal efficiency is fast blazing of the fuel.

Table 7: Brake Specific Fuel Consumption

S. No	Diesel	B10	B20	B30	B40	B50
1	0.713	0.731	0.763	0.858	0.847	0.593
2	0.388	0.377	0.386	0.437	0.431	0.358
3	0.328	0.320	0.313	0.362	0.356	0.295
4	0.274	0.296	0.298	0.297	0.324	0.263
5	0.266	0.292	0.289	0.285	0.318	0.256
6	0.262	0.286	0.281	0.290	0.298	0.262

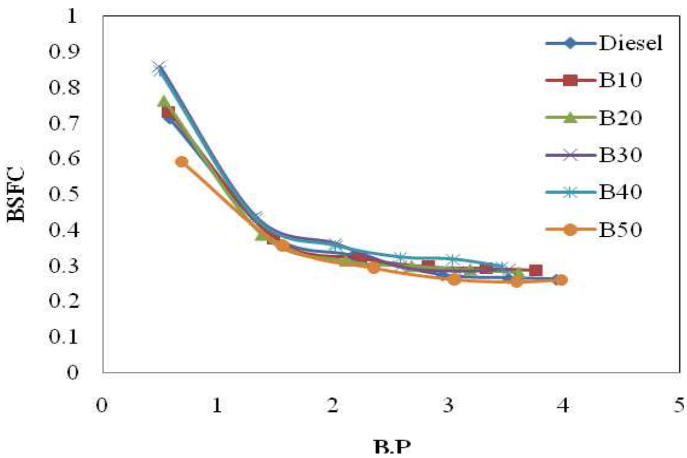

Figure 3: Variation of Brake Power with Brake Specific Fuel Consumption.

Table 8: Brake Thermal Efficiency

S. No	Diesel	B10	B20	B30	B40	B50
1	11.130	10.623	10.670	10.005	10.603	15.622
2	20.416	20.587	21.047	19.619	20.811	25.861
3	24.131	24.226	25.957	23.721	25.170	31.399
4	28.929	26.189	27.267	28.890	27.696	35.228
5	29.840	26.563	28.153	30.144	28.192	36.158
6	30.24	27.093	28.979	29.614	30.121	35.353

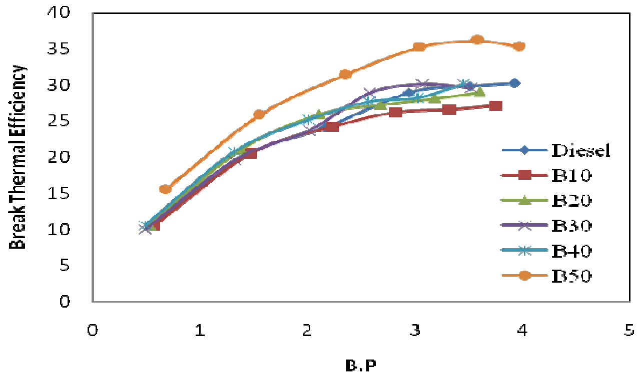

Figure 4: Variation of Brake Power with Brake Thermal Efficiency.

Indicated Thermal Efficiency

Indicated thermal efficiency is defined as the ratio of power of the engine to heat input. From the Figure 5, it is observed that the indicated thermal efficiency of the B50 Blend has higher in contrast to diesel and all other blends. Graph is plotted between brake power and indicated thermal efficiency of coconut and neem oil blends as demonstrated in Figure 5.

Table 9: Indicated Thermal Efficiency

S. No	Diesel	B10	B20	B30	B40	B50
1	30.285	27.327	28.757	24.335	29.960	31.645
2	34.497	33.115	34.793	30.023	34.936	37.514
3	35.289	33.970	37.050	31.966	36.418	40.763
4	38.759	34.541	36.430	36.742	37.375	43.343
5	38.341	33.755	36.111	37.015	36.563	43.233
6	37.944	33.589	36.213	35.503	37.968	41.596

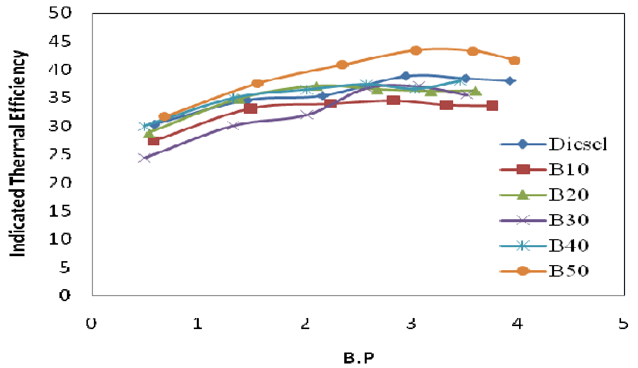

Figure 5: Variation of Brake Power with Indicated Thermal Efficiency.

Mechanical Efficiency

Mechanical efficiency is defined as the ratio of brake power to indicated power. From the figure 6, it is evident that B50 has greater mechanical efficiency in contrast to diesel. This is mainly due to less frictional power. The plots of mechanical efficiency with respect to brake power is shown in figure 6.

Table 10: Mechanical Efficiency

S. No	Diesel	B10	B20	B30	B40	B50
1	36.783	38.874	37.106	41.114	35.391	49.367
2	59.183	62.169	60.493	65.346	59.568	68.937
3	68.380	71.315	70.059	74.207	69.114	77.028
4	74.638	75.820	74.846	78.629	74.104	81.276
5	77.827	78.693	77.962	81.438	77.106	83.635
6	79.695	80.660	80.022	83.412	79.331	84.992

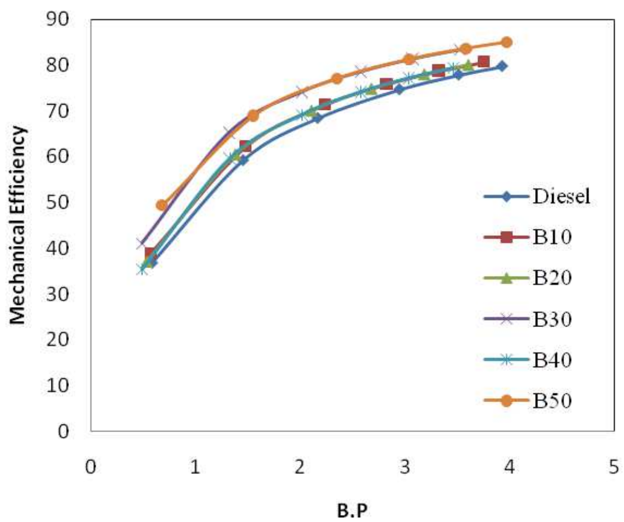

Figure 6: Variation of Brake Power with Mechanical Efficiency.

Volumetric Efficiency

Volumetric efficiency is defined as the ratio of the volume of fluid actually displaced by a plunger to its swept volume. Super chargers and turbo chargers increases the pressure entering the cylinders, giving the engine a better volumetric efficiency. From the figure it is observed that volumetric efficiency of all the blends are lower when contrasted with diesel. The variation of brake power with volumetric efficiency is shown in figure 7.

Table 11: Volumetric Efficiency

S. No	Diesel	B10	B20	B30	B40	B50
1	91.751	95.224	95.224	95.224	95.224	95.224
2	91.751	95.224	95.224	95.224	95.224	95.224
3	91.751	95.224	95.224	95.224	95.224	95.224
4	91.751	95.224	95.224	95.224	95.224	95.224
5	91.751	95.224	95.224	95.224	95.224	95.224
6	91.751	95.224	95.224	95.224	95.224	95.224

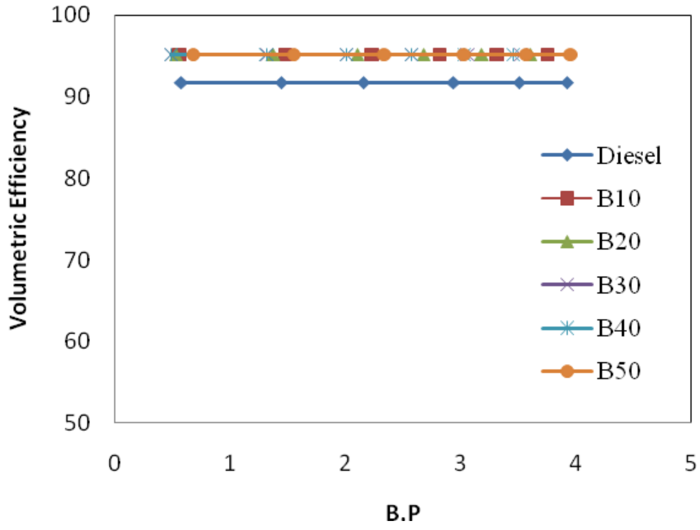

Figure 7: Variation of Brake Power with Volumetric Efficiency.

CONCLUSIONS

The performance characteristics of the diesel engine using dual biodiesel blend were determined. The following conclusions are drawn.

- The BSFC of the blend B50 has lesser specific fuel consumption compared to other blends.
- The brake thermal efficiency of B50 blend is greater in contrast to all other blends.
- The indicated thermal efficiency of B50 blend is greater when contrasted with other blends.
- The mechanical efficiency of the B50 blend is greater contrasted with other blends.
- The volumetric efficiency of all blends is greater than diesel.

Despite the fact that neem biodiesel properties are not superior, with the accumulation of coconut biodiesel altered the properties fundamentally. The present work demonstrated that it is conceivable to mix dual biodiesels to get attractive properties of fuel rather than the standard routine with regards to mixing fossil diesel with a biodiesel. Finally we concluded that utilization of coconut and neem oil blends can be used as a alternative fuels for compression ignition engines.

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